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GEORGE R. BROWN CONVENTION CENTER

IMPROVED MECHANICAL SEAL DESIGN FOR HIGH TEMPERATURE /LIGHT SLURRY APPLICATIONS

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Author Biographies

Jose Martin is an engineer with the Applied Technical Solutions group of Flowserve Seals in Temecula, CA. He has over 20 years experience in mechanical seals including design and troubleshooting. He has held on-site positions at various refineries, serving as a sealing expert. He is currently assisting the field sales force in Latin America and western Canada. He received his BS in mechanical engineering from University of Guadalajara.

Chris Riché is an Applied Technical Solutions Engineering Supervisor in the Flow Solutions Division of Flowserve Seals in Temecula, CA. He has over 10 years experience in the design, testing and evaluation of mechanical seals and systems. He has also served as a field resource for difficult applications during his time with Flowserve. He received his BS in mechanical engineering from Louisiana State University.

Abstract

Extracting hydrocarbon products in oil sand formations requires high pressure to drive fluid out of the formation and to move the products out to production. The pump models that fit this operating envelope are not common in abrasive services. Mechanical seals that are normally installed in these pumps types are commonly API 682 type designs and are not well suited to handle abrasives.

This case study reviews an application where a bad actor conventional seal was replaced by a hybrid seal design to handle a high temperature, light slurry process while still providing low barrier fluid consumption.

Agenda

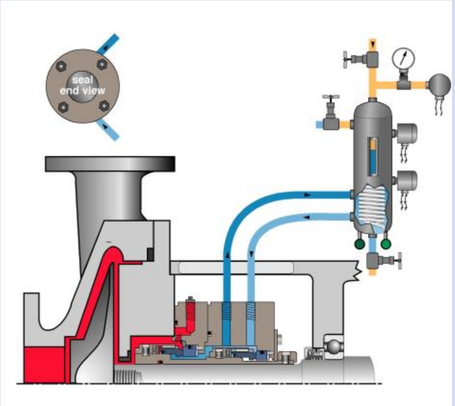
- Application description
- Challenges
- Review of previous solutions
- Description of developed solution
- Field results
- Lessons learned

Application Description

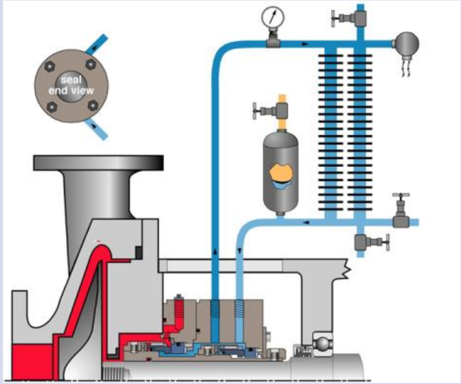
- Fluid: Hot bitumen with solids (sand, pipe debris)+ H_2S
- Temperature: 275° – 302 ° F (135° – 150° C)
- Pressure: 4.3 – 25.9 psig (29.6 – 178.6 kPag)
- Shaft Speed: 1190 RPM
- Shaft Size: 3.740” (95 mm)
- API Plan 53B

Challenges

- High temperature
- Solids in process
- Limited barrier reservoir capacity

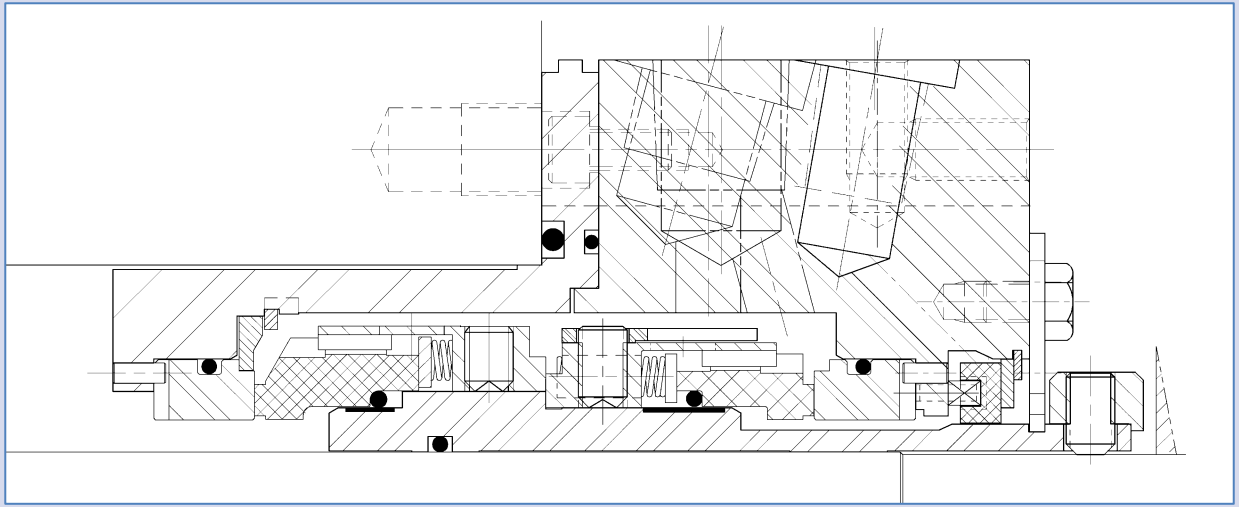


API Plan 53A



API Plan 53B

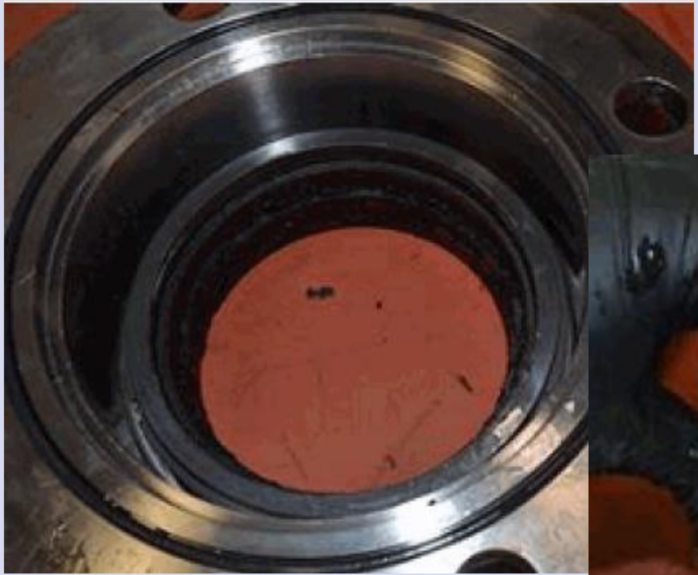
Review of Previous Solution



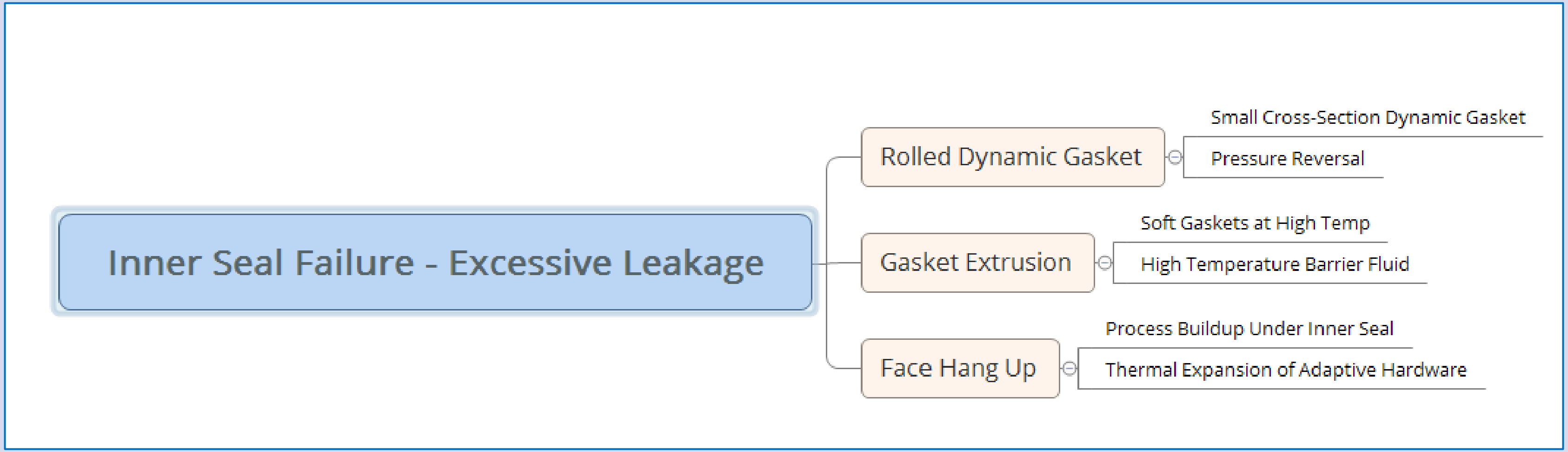
- Proven design - API 682 Type A
- High pressure capability
- Faces exposed to barrier fluid
- Prone to clogging
- Insufficient materials
- Mechanical face retention

Average seal life less than one month

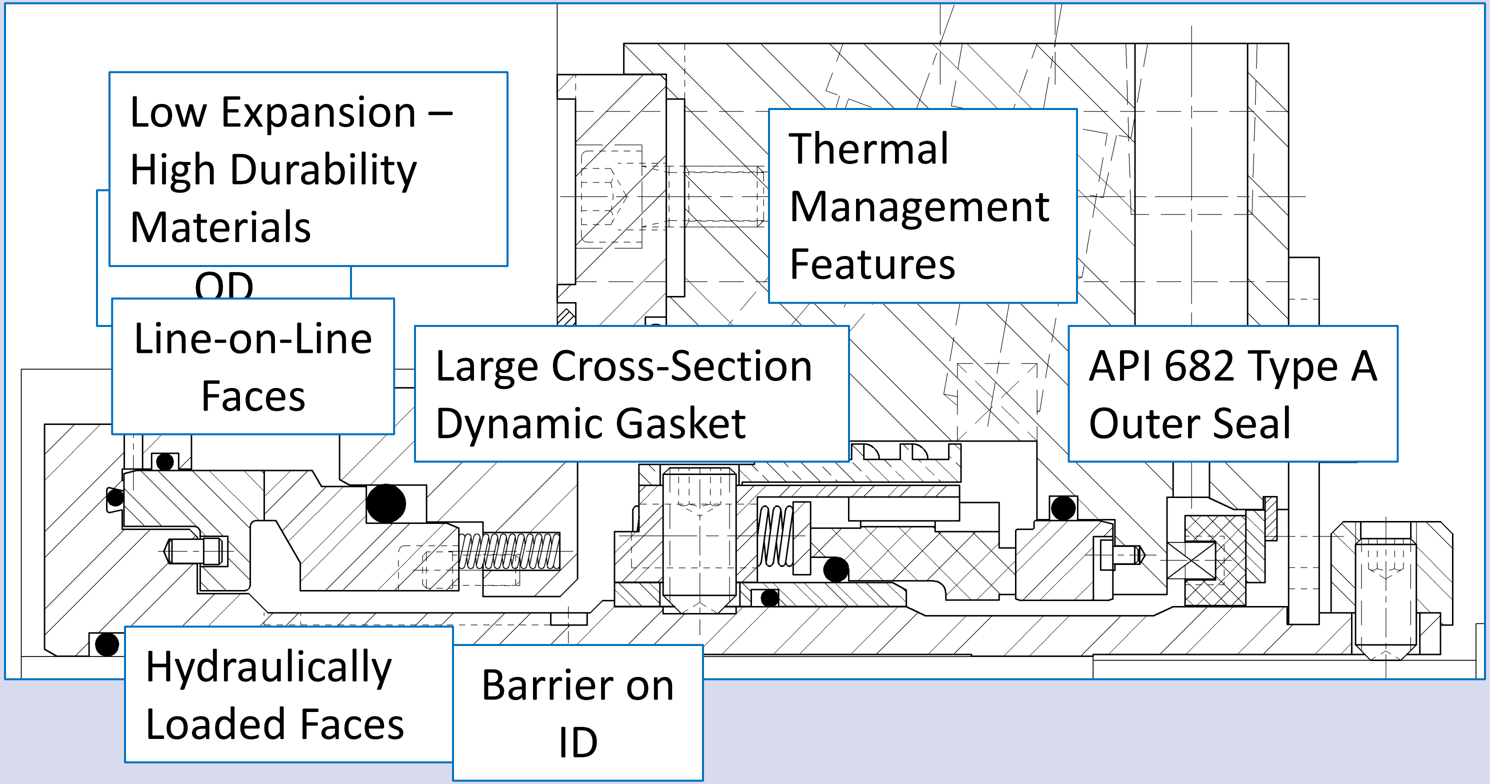
Review of Previous Solution



Review of Previous Solution



Description of Developed Solution



Field Results

- Seal installed in June 2015
- Very low barrier fluid consumption
- Removed in April 2016 due to reverse rotation
- Examination of seal faces showed no damage or wear

Field Results

Lessons Learned

- Thermal expansion considerations
- Barrier temperature management
- Dynamic gasket sizing

Recommendations

- Seal faces must place process on OD
  - Slurry design features
  - High ID pressure capability
- Materials should be selected to reduce differential thermal expansion
- Review barrier system design for cooling capacity
- Select low leakage outer seals